
Preface

Over the last decade the development of new molecular biology tools, advanced microscopy, live imaging, and systems biology approaches have revolutionized our conception of how embryonic development proceeds. One fundamental aspect of development biology is the concept of morphogenesis: understanding how a group of multipotent cells organize and differentiate into a complex organ. The mouse kidney is one of the classical model systems to study the mechanism of morphogenesis. The developing kidney has the great advantage to recapitulate many of the key process of embryonic development such as cell–cell interactions, cell movement, cell division, cell survival and death, mesenchymal to epithelial transformation, and epithelial branching morphogenesis, and also some unique features such as the formation of the glomerulus. In addition, kidney organogenesis has the great advantage to occur in ex vivo culture, which allows the study, in a dish, of many aspects of its development, particularly branching morphogenesis of the collecting duct system and nephrogenesis. Understanding the process of morphogenesis is of fundamental importance not only for studying developmental biology per se but also for regenerative medicine.

This book is divided into different chapters, written by specialists in each field, which present different approaches to tackle kidney development. The reader will be guided through the different tools that will allow her/him to study many important parts of kidney development at tissue, cellular, and molecular levels. The aim is to provide a useful and valuable bench reference for both experts and nonexpert scientists who wish to study kidney development.

Part I regroups protocols that introduce the dissection, culture, and live imaging aspects of kidney development. Part II deals on how to analyze the three-dimensional aspects of branching morphogenesis as well as nephrogenesis. Part III consists of protocols that utilize different cell types, from primary cell lines to immortalized ones, to study different aspects of cell signaling and cell migration. Parts IV and V focus on how to analyze and manipulate gene/protein expression during kidney development as well as in the adult kidney. Finally, Part VI concentrates on the adult kidney and how to assess kidney malformation and disease. It is important to note that except for Chap. 6 (zebrafish) and Chap. 11 (Xenopus), the rest of the protocols focus on mouse kidney. I believe that most protocols, especially Parts III–IV, can be adapted to other developing organs and can be very useful not only for kidney organogenesis.

In the end I would like to thank John Walker for giving me the opportunity to edit this book and all the authors for making this book a reality. It has been a great experience and I hope that this first issue of *Methods in Molecular Biology* focusing specifically on (kidney) organogenesis will be a success and will pave the way for future issues in this area of research. Finally, I'm grateful to Antonella Galli for her help, support, and patience.

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